

## **High-Efficiency Food Production in a Renewable Energy Based Micro-Grid Power System**

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Controlled Environment Agriculture (CEA) systems can be used to produce high-quality, desirable food year round, and the fresh produce can positively contribute to the health and well being of residents in communities with difficult supply logistics. While CEA has many positive outcomes for a remote community, the associated high electric demands have prohibited widespread implementation in what is typically already a fully subscribed power generation and distribution system. Recent advances in CEA technologies as well as renewable power generation, storage, and micro-grid management are increasing system efficiency and expanding the possibilities for enhancing community supporting infrastructure without increasing demands for outside supplied fuels. We will present examples of how new lighting, nutrient delivery, and energy management and control systems can enable significant increases in food production efficiency while maintaining high yields in CEA. Examples from Alaskan communities where initial incorporation of renewable power generation, energy storage and grid management techniques have already reduced diesel fuel consumption for electric generation by more than 40% and expanded grid capacity will be presented. We will discuss how renewable power generation, efficient grid management to extract maximum community service per kW, and novel energy storage approaches can expand the food production, water supply, waste treatment, sanitation and other community support services without traditional increases of consumable fuels supplied from outside the community. These capabilities offer communities with a range of choices to enhance their communities. The examples represent a synergy of technology advancement efforts to develop sustainable community support systems for future space-based human habitats and practical implementation of infrastructure components to increase efficiency and enhance health and well being in remote communities today and tomorrow.

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